NATIONAL CLASS A FOAM RESEARCH PROJECT
TECHNICAL REPORT

STRUCTURAL FIRE FIGHTING - ROOM BURN TESTS
Phase II

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EXECUTIVE SUMMARY

Class A foams have been used to fight forest and brush fires for many years. Recently, municipal fire departments have been using Class A foams to improve the operating efficiency of manual hose streams for structural fire fighting purposes. Phase I of this Research Project involved the conduct of laboratory analysis, wood crib fire, retention and exposure protection tests as described in the National Fire Protection Research Foundation (NFPRF) Report on Class A Foam for Manual Hose Streams dated December, 1993.

This report covers Phase II of the Research Project which involved the conduct of a series of structural fire suppression tests in an 8 by 12 by 8 ft (2.4 by 3.7 by 2.4 m) high enclosure. The enclosure was positioned so that the products of combustion were collected in a calorimeter hood. This permitted measurement of the heat release rate for each test.

Two series of fire tests were conducted in the enclosure. For both series, the walls of the enclosure were fitted with plywood wall paneling having a Flame Spread Index[1] (FSI) of 200 and the ceiling was fitted with tile having an FSI of 25. For the first series of fire tests, a residential sprinkler fuel package as described in the Standard for Residential Sprinklers for Fire Protection Service, UL 1626, and which simulates the upholstered furniture fuel package used in the Los Angeles Residential Sprinkler Tests[2], was placed in a corner of the enclosure. An opening 5 ft wide by 7 ft (1.5 by 2.1 m) high was centered in one end of the enclosure for test observation and manual application of the agent.

The fuel package was ignited and the time to reach flashover in the enclosure was recorded. Five seconds after flashover, either plain water, Class A foam or Class A compressed air foam (CAF) was applied until suppression was achieved.

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[1]Flame Spread Index (FSI) is a fire spread characteristic measured in accordance with the Standard for Test for Surface Burning Characteristics, ANSI/UL 723.

[2]"Sprinkler Performance in Residential Fire Tests," Technical Report RC8-T-16, Serial No. 22574, Factory Mutual Research Corporation, July, 1980.

For the second series of tests, the fuel package was changed to an upholstered L-shaped sofa located in the corner of the room. The sofa was ignited in the corner and permitted to burn until flashover occurred. Five seconds after flashover, plain water, Class A foam or Class A CAF was applied until suppression was achieved.

The results of the Phase II fire tests indicated that the use of Class A foam solutions generally reduced the amount of heat released from the fire and damage to the combustibles as compared to plain water. In the Series I fire tests at 5 gpm (18.9 lpm), Class A foam applied using the direct application method took less time and had a lower total heat release from agent application until the rate of heat release was reduced to 500 kW as compared to plain water. No fire tests were conducted with Class A CAF applied using the direct application method. With the agents applied using the indirect method, water and Class A foam had almost identical test results whereas the Class A CAF values were higher. For the Series II fire tests, Class A foam applied at 10 gpm (37.9 lpm) using the indirect method took less time and quantity of agent to reduce the rate of heat release to 500 kW as compared to Class A CAF and water only. However, Class A CAF applied at 7 gpm (26.5 lpm) using a direct application method had the shortest time and lowest quantity of agent to reduce the rate of heat release to 500 kW.

It is recommended that additional research be conducted to develop product performance criteria for Class A foams and a method to evaluate specific combinations of Class A foams, proportioning and foam generation methods.

4.0 DISCUSSION AND RECOMMENDATIONS

DISCUSSION:

GENERAL

The data developed during this series of room fire suppression tests conducted using a single representative Class A foam concentrate generally demonstrated the ability of manual hose streams supplied with Class A foam solutions to provide enhanced structural fire fighting performance as compared to manual hose streams supplied with water only. It should be noted that all tests were performed under laboratory conditions using specific, repeatable test methods and procedures.

FOAM QUALITY

The results of the foam quality tests conducted with the discharge devices indicated that Class A CAF had the highest expansion ratios and longest 25 percent drainage times. It should also be recognized that the standard spray test nozzle used with the Class A foam solution in this Research Project was designed to operate with water only.

ROOM FIRE SUPPRESSION TEST

During the Series I fire tests employing the UL 1626 residential sprinkler fuel package, the polyether foam was essentially consumed at 100 seconds. There was limited time between flashover, which generally occurred at 80 to 90 seconds, and burnout of the foam, which generally occurred at 100 seconds, for the agent to gain suppression of the fuel package. Based upon a review of the data provided in ILLS. 7 and 8, the following observations were made:

1. Class A foam applied using a direct application method took less time and quantity of agent and had a lower total heat release from agent application until the rate of heat release was reduced to 500 kW than plain water.

2. Using the indirect application method, water and Class A foam had almost identical application times, quantities of agent and total heat release from agent application until the rate of heat release was reduced to 500 kW, whereas Class A CAF values were higher.

For the Series II fire tests, there was sufficient fuel available for the agent to suppress the corner sofa fuel package prior to consumption of the mattresses. Based upon a review of data provided in ILLS. 9-11, the following observations were made:

1. When compared to water only, the test results using Class A foam solutions generally provided for a reduced amount of total heat release from the fire and less damage to the sofa.

2. In general, Class A foam applied at 10 gpm (37.9 lpm) using the indirect method took less time and quantity of agent to reduce the rate of heat release to 500 kW as compared to Class A CAF or water only.

3. Class A CAF applied at 7 gpm (26.5 lpm) using a direct application method had the shortest time and lowest quantity of agent to reduce the rate of heat release to 500 kW.

4. Although direct application of water at >30 gpm (>113.6 lpm) had the fastest suppression time and lowest total heat release and damage, the flow rate was at least three times higher than the flow rate used for the Class A foam room fire tests.

5. The direct application method provides for a reduced amount of total heat release and less damage to the sofa as compared to the same tests conducted using the indirect application method.

RECOMMENDATIONS:

It is recommended that additional research be conducted to develop performance criteria for evaluating the ability of Class A foams to suppress and/or prevent ignition of ordinary combustibles. It may also be desirable to develop a method of evaluating a Class A foam in combination with proportioning and foam generating equipment.

Additional tests should be undertaken to further quantify the fire fighting performance and overall improvement in operating efficiency when Class A foam solutions are used with hand hoselines for structural fire fighting.

Additional research should also be conducted to determine the optimum tactical approach in manual fire combat for different Class A foam expansion ratios, drain times, and bubble structures.